Performance and Condemnation Rate Analysis of Commercial Turkey Flocks Treated with a *Lactobacillus* spp.-Based Probiotic

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ABSTRACT The use of defined probiotic cultures in the poultry industry has recently become more common. However, few conclusive studies regarding their efficacy under commercial conditions have been reported in the scientific literature. We conducted a study that included 118 commercial turkey hen lots, ranging from 1,542 to 30,390 hens per lot, of either Nicholas or Hybrid genetic lines, to look at the effect of a selected commercial *Lactobacillus*-based probiotic (FM-B11) on turkey BW, performance, and health. Sixty lots received the probiotic, whereas 58 lots were controls without probiotic. The probiotic was administered for 3 consecutive days at placement (day of age) and at move-out (around 6 wk of age, movement from brooder to grower houses). The parameters collected, calculated, and analyzed (significance level $P < 0.05$) were market BW, average daily weight gain, feed conversion ratio, and cost of production. There was no interaction effect between the genetic line and probiotic effect. Therefore, data from the 2 genetic lines were combined for the statistical analysis of the probiotic effect. The probiotic significantly improved market BW and average daily gain by 190 and 1.63 g, respectively. The feed conversion ratio was not statistically different between treatments (2.176 vs. 2.192 for the probiotic and control, respectively). However, the cost of production was lower in the probiotic-treated (58.37 cents/kg of live turkey) than in the control (59.90 cents/kg of live turkey) lots. Condemnation rates were not significantly different between lots. When each premise was compared by level of performance as good, fair, or poor (grouping based on historical analysis of 5 previous flocks), the probiotic appeared to increase the performance of the poor and fair farms. Use of the selected commercial probiotic resulted in increased market BW and reduced cost of production.

Key words: probiotic, health, production cost, turkey

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INTRODUCTION

Defined *Lactobacillus* spp.-based probiotics are increasingly being used in the poultry industry as a way to control foodborne pathogens (Vahjen et al., 2002; Bielke et al., 2003; Priyankarage et al., 2004) and also as a preventative health management strategy that maintains the dominance of beneficial bacteria over undesirable bacteria in the intestinal tract (Jin et al., 1998; Vahjen et al., 2002). By helping to control the pathogenic or undesirable bacterial populations in the gastrointestinal tract, selected probiotic cultures may potentially increase performance parameters of avian species. Isolated reports have claimed improvements in BW gain under controlled experimental conditions (Jin et al., 1998; Huang et al., 2004); however, convincing reports on the effects of defined probiotics under true commercial conditions in turkeys are lacking. To elucidate whether selected probiotic cultures are a real alternative for growers with respect to bird performance, 118 commercial turkey lots were included in this study to examine the effect of a defined probiotic on the performance and health of turkey hens.

MATERIALS AND METHODS

A total of 118 commercial turkey hen lots of 2 genetic lines, Nicholas or Hybrid, were randomly assigned, within service technician geographic areas, to a probiotic treatment (60 hen lots received probiotic FM-B11; IVS/Wynco, LLC, Springdale, AR) or controls with no probiotic administered (58 control hen lots). The probiotic was administered in drinking water through the medicator,

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Table 1. Effect of a probiotic on turkey hen market weight (kg ± SE) and average daily gain (ADG, kg ± SE) by level of productivity[1]

Productivity level	Treatment	Weight (kg)	ADG (g)	n	Age (d)
Good	Control	6.93 ± 0.09[a]	75.01 ± 0.72[a]	6	92.33
	Probiotic	6.96 ± 0.06[a]	74.82 ± 0.63[a]	22	92.95
Fair	Control	6.75 ± 0.06[a]	73.35 ± 0.60[a]	32	92.09
	Probiotic	6.92 ± 0.06[b]	75.10 ± 0.53[b]	22	92.18
Poor	Control	6.57 ± 0.09[a]	71.50[a] ± 0.64	15	91.87
	Probiotic	6.85 ± 0.07[b]	73.50 ± 0.65[b]	12	93.17

[a,b]Means within a group with different lowercase letters differ ($P < 0.05$).

[1]Grouping was based on historical farm production reports and was arbitrarily divided as the top 25% (good), bottom 25% (poor), and middle 50% (fair).

following directions by the supplier, to achieve a final concentration of 10^6 cfu/mL for 3 consecutive days at placement (day of age) and at move-out (around wk 6 of life).

Data were collected at the processing plant for BW and condemnations by pathological condition. Cost of production (cents/kg of live turkey) was also estimated by formulas used by the production company.

The data collected were subjected to ANOVA for market BW, average daily gain, cost of production, and feed conversion ratio. The statistical randomized design included treatment (probiotic or control) and genetic line as main effects, with the interaction between the 2 and age as covariables (Steel and Torrie, 1960). Condemnation data were analyzed through the Wilcoxon rank test (Moore and McCabe, 1999). All statistical analyses were performed by GLM and NPAR1WAY procedures of SAS v. 9.1 (SAS Institute, 1999) for performance and condemnation data, respectively. Statistical significance was considered when $P < 0.05$.

Following this analysis, each premise was compared by level of performance as good, fair, or poor (grouping based on historical analysis of 5 previous flocks) using internal integrator criteria. The historical production records included performance information such as weight at market age, feed consumption, and medication costs based on proprietary information within the company. Out of the 118 lots included in this trial, only 109 were included in the subgrouping because of a lack of historical information for some farms. These historical production records were used to classify farms into 3 different performance ranking groups. Arbitrarily, the groups were classified with 25% of the best and worst ranking farms as good and poor, respectively. Lots of turkeys raised on farms ranking between the best 25% and worst 25% were classified as being raised on farms in the fair group.

RESULTS AND DISCUSSION

The average lot size was 12,662 turkey hens, with a range from 1,542 to 30,390 birds. The total numbers of processed birds for the control and probiotic treatments were 719,424 and 774,718, respectively. Market BW and average daily gain were influenced by the probiotic treatment ($P < 0.05$) and genetic line ($P < 0.01$). No significant interaction was observed between treatment and genetic line ($P > 0.05$). The covariable age influenced market BW ($P < 0.001$) but not average daily gain ($P > 0.05$).

Flocks treated with the probiotic were heavier [6.91 ± 0.034 vs. 6.72 ± 0.035 kg (± SE)] and had higher BW gain [74.5 ± 0.38 vs. 73.1 ± 0.39 g/d (± SE)] than untreated controls ($P < 0.05$). The statistical analysis failed to detect an effect of probiotic treatment on the feed conversion ratio (2.192 and 2.176 for the control and probiotic treatment, respectively), whereas the economic analysis indicated a probiotic effect ($P < 0.01$), with a lower cost per kilogram of live turkey after including the probiotic cost (59.90 and 58.37 cents/kg of live turkey for the control and probiotic treatment, respectively).

The combination of a higher daily weight gain and a small (by 0.016 units) reduction in the feed conversion ratio associated with addition of the probiotic may have contributed to the lower cost of production, even after considering the costs for addition of the probiotic, with an estimated additional income per turkey hen of about US 10 cents.

Attempts to further understand the effects of the probiotic on subpopulations were made by grouping the farms that participated in this trial into 3 categories based on the ranking provided by the integrator. A summary of the findings is present in Table 1. The fair and poor groups appeared to respond favorably to administration of the probiotic ($P < 0.05$), whereas the good group did not appear to respond to administration of the probiotic ($P > 0.5$), as evaluated by increased BW. The favorable response observed in the group with fair productivity was not surprising. This group included the mid 50% of the analyzed lots. Statistical analysis of the whole data set before grouping indicated statistical significance between the probiotic and control groups. The lack of response observed for the good performers may not be surprising because the effect of the probiotics may relate to an overall health status improvement with less opportunity to affect top-performing flocks, in part because of a relatively lower level of environmental challenge. Assuming that birds on the farms designated as good were in good health, they were less likely to respond to administration of the probiotics. By using a similar rationale, those farms historically ranked as poor might

be considered less likely to respond to the probiotic treatment, given the potential for their performance rank to be influenced by an array of management and environmental issues. Nevertheless, lots originating from these farms responded favorably to the probiotic used in this experiment.

Pathological condition categories considered for condemnation included tumors, avian tuberculosis, respiratory system abnormalities, sepsis, bruises, trimmed parts, and others. No apparent trend was observed regarding condemnation at processing attributed to application of the probiotic ($P > 0.05$). Total condemnation rates for control and probiotic-treated flocks were 1.02 and 0.98%, respectively, reflecting a good health status on the farms evaluated.

The results provided by this trial suggest that administration of the selected probiotic (FM-B11) to turkeys increased the average daily gain and market BW, representing an economic alternative to improve turkey production. The observed effects seemed to be due to better responses in subpopulations of flocks with a fair to poor performance history, whereas those with a history of good performance seemed to respond less favorably to the probiotic supplementation.

REFERENCES

Bielke, L. R., A. L. Elwood, D. J. Donoghue, A. M. Donoghue, L. A. Newberry, N. K. Neighbor, and B. M. Hargis. 2003. Approach for selection of individual enteric bacteria for competitive exclusion in turkey poults. Poult. Sci. 82:1378–1382.

Huang, M. K., Y. J. Choi, R. Houde, J. W. Lee, B. Lee, and X. Zhao. 2004. Effects of lactobacilli and an acidophilic fungus on the production performance and immune responses in broiler chickens. Poult. Sci. 83:788–795.

Jin, L. Z., Y. W. Ho, N. Abdullah, and S. Jalaludin. 1998. Growth performance, intestinal microbial populations, and serum cholesterol of broilers fed diets containing *Lactobacillus* cultures. Poult. Sci. 77:1259–1265.

Moore, D. S., and G. P. McCabe. 1999. Introduction to the Practice of Statistics. 3rd ed. W. H. Freeman and Co., New York, NY.

Priyankarage, N., S. S. P. Silva, G. A. Gunawardana, M. W. C. D. Palliyaguru, W. M. P. B. Weerasinghe, G. K. C. N. Fernando, and R. Chandima. 2004. Effect of different probiotics against a lethal dose of *Salmonella* challenge in broiler chickens. Br. Poult. Sci. 45(Suppl.1):S43–S45. (Abstr.)

SAS Institute. 1999. SAS Online Doc. Version 8. SAS Institute Inc., Cary, NC. http://v8doc.sas.com/sashtml Accessed Aug. 2005.

Steel, R. G., and J. H. Torrie. 1960. Principles and Procedures of Statistics. McGraw-Hill, New York, NY.

Vahjen, W., A. Jadamus, and O. Simon. 2002. Influence of a probiotic *Enterococcus faecium* strain on selected bacterial groups in the small intestine of growing turkey poults. Arch. Anim. Nutr. 56:419–429.